STATE OF VERMONT
PUBLIC SERVICE BOARD

Docket No. ________

Petition of twenty Vermont utilities and	)
Vermont Public Power Supply Authority	)
requesting authorization pursuant to 30	)
V.S.A. § 248 for the purchase of shares of	)
218 MW to 225 MW of electricity from H.Q.	)
Energy Services (U.S.) Inc. commencing	)
November 1, 2012 through 2038, issuance of	)
findings that such purchases are entitled to	)
rate recovery assurance, and requesting	)
certain approvals under 30 V.S.A. § 108	)

JOINT PREFILED TESTIMONY OF JAMES CATER, CHARLES WATTS AND WILLIAM J. DEEHAN ON BEHALF OF CENTRAL VERMONT PUBLIC SERVICE CORPORATION

August 17, 2010

In their joint testimony, witnesses Cater, Watts and Deehan support (i) why the HQUS PPA is needed to meet CVPS demand requirements (Section 248(b)(2) (need)), and (ii) how the HQUS PPA provides an economic benefit to CVPS, its customers and the state (Section 248(b)(4) (economic benefit)), and is consistent with the CVPS IRP (Section 248(b)(6) (IRP)).

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1. <u>Introduction</u>

Q1. Please state your name, occupation and business address.

A1. <u>James Cater:</u>

My name is James Cater. I am Director of Power Supply and Strategic Analysis for Central Vermont Public Service Corporation ("Central Vermont," "CVPS," or the "Company"). Our business address is CVPS, 77 Grove Street, Rutland, VT 05701.

<u>Charles Watts:</u>

My name is Charles Watts. I am Manager of Strategic Analysis at CVPS.

William Deehan:

My name is William J. Deehan. I am the Vice President of Power Planning and Regulatory Analysis at CVPS.

Q2. Please summarize your education, training and professional experience.

A2. James Cater:

My qualifications are set forth in my resume, Exhibit CVPS-1.

Charles Watts:

My qualifications are set forth in my resume, Exhibit CVPS-2.

William Deehan:

My qualifications are set forth in my resume, Exhibit Petitioners' Joint-1.

Q3. What is the purpose of your testimony?

A3. Our testimony supports Central Vermont's decision to move forward as a Buyer under the Power Purchase and Sale Agreement ("HQUS PPA" or "PPA") dated August 12, 2010 with H.Q. Energy Services (U.S.) Inc. ("HQUS") as Seller. The HQUS PPA is included with this filing as Confidential Exhibit Petitioners' Joint-3 and is described in the joint prefiled testimony of William Deehan and Christopher Cole.

Specifically, our testimony addresses why the HQUS PPA is needed to meet CVPS energy demand requirements (30 V.S.A. Section 248(b)(2) (need)), how the HQUS PPA provides an economic benefit to CVPS, its customers and the state (Section 248(b)(4) (economic benefit)), and explains how the HQUS PPA is consistent with the CVPS IRP (Section 248(b)(6) (Integrated Resource Plan ("IRP")). As such, our testimony complements and supplements the joint Deehan/Cole prefiled testimony that is offered on behalf of all Petitioners.

Q4. Please summarize your conclusions and recommendations.

A4. Our analysis supports a conclusion that the proposed PPA represents an attractive opportunity for CVPS to purchase a very much needed and significant long-term, highly reliable quantity of power that is priced in a manner that produces a significant and reasonable hedge against spot market price volatility while having an expected cost that is consistent with non-renewable sources of power. While there is no specific organized market for the renewable attributes of the Hydro Québec ("HQ") production system at this time, those attributes are primarily renewable, sustainable and have comparatively low air emissions.

We base our conclusions on CVPS' IRP analytical tools: portfolio analysis and multi-attribute scoring and ranking (a.k.a., CVPS' "scorecard"), as recently reviewed by the Board in Central Vermont's Granite Reliable Wind § 248 proposal in Docket No. 7589. In addition, we have included the results of Monte Carlo simulation analysis used here to understand the nature of the price-hedge which this PPA represents across the wide distribution of market price futures. The credit terms are beneficial for Central Vermont – particularly should the Board find that rate recovery assurance is justified (as the Collateral Agreement provides for substantially improved credit terms if rate recovery assurance is provided by this Board). This is attractive because the Company's liquid capital resources are limited, and it is valuable to preserve that capacity for other future purchases that will be needed to replenish the portfolio. We ask the Board to approve CVPS' purchases under this agreement; we identify our capacity to purchase additional amounts (should approval processes result in "Removed Buyers") and we recommend that the cost of the purchase be recoverable in rates subject to our ongoing prudent management.

2. Central Vermont's HQUS PPA Power Purchase Entitlements

Q5. Please describe Central Vermont's power purchase entitlements under the HQUS PPA.

A5. The HQUS PPA includes six schedules of hourly volumes to be transacted ("Energy Quantity"), each with a set hourly volume and start and end date, within two allocation tables as contained in Appendix 3.2(c)(i) and (ii) of the PPA. At the outset, the Energy Quantity is based upon the current transfer capability of the Highgate Converter, which is 218 MW, and therefore 218 MW is the Energy Quantity allocated among the Vermont Buyers. If Highgate's transfer capability is increased to 225 MW during the term of the PPA, the Energy Quantity will increase to 225 MW and the allocations among the Vermont Buyers will increase to the values shown in Appendix 3.2(c)(ii) of the PPA .

As the Board is aware, CVPS has announced its intention to purchase the assets and service area of the Vermont Marble Power Division of OMYA Inc. ("Vermont Marble") and expects that transaction to close by November 1, 2010, at which time (pending Board approval) CVPS will be the purchaser of both its own and Vermont Marble's allocations under the PPA. The following tables identify Central Vermont's purchases under the 218 and 225 MW circumstances with and without assumption of Vermont Marble's shares:

CVPS' SHARES OF THE ENERGY QUANTITY AT 218 MW

	November 1, 2012 to October 31, 2015	November 1, 2015 to October 31, 2016	November 1, 2016 to October 31, 2020	November 1, 2020 to October 31, 2030	November 1, 2030 to October 31, 2035	November 1, 2035 to October 31, 2038
	MW	**MW**	**MW**	**MW**	**MW**	**MW**
CVPS	0	83.119	94.119	95.119	105.809	22.69
Vermont Marble	3	4	4	4	1.559	0.559
Total	3	87.119	98.119	99.119	107.368	23.249

CVPS' SHARES OF THE ENERGY QUANTITY AT 225 MW

	November 1, 2012 to October 31, 2015	November 1, 2015 to October 31, 2016	November 1, 2016 to October 31, 2020	November 1, 2020 to October 31, 2030	November 1, 2030 to October 31, 2035	November 1, 2035 to October 31, 2038
	MW	**MW**	**MW**	**MW**	**MW**	**MW**
CVPS	0	85.419	96.419	98.419	112.101	26.682
Vermont Marble	5	5	5	5	0.716	0.716
Total	5	90.419	101.419	103.419	112.817	27.398

As we discuss in Q&A 10, below, given the significant supply gap that CVPS is facing, the Company is requesting the Board to approve CVPS' purchase of up to an additional 25 MW of energy and associated environmental attributes should one or more other Buyers not receive their necessary approvals.

Q6. How do the quantities of energy you are purchasing under the HQUS PPA compare to your current power purchases from Hydro-Québec under the Firm Power and Energy Agreement with Hydro-Québec (the "VJO Contract")?

A6. Under the PPA, CVPS will be purchasing a smaller hourly volume (typically 95 to 112 MW over the 2016-2035 contract year period[1] versus 143 MW now purchased by CVPS) for a fewer number of hours (sixteen hours per day vs. an average of eighteen hours). Therefore, the energy volume purchased each year is scaled down significantly from current purchases under the VJO Contract (around 30% less).

Q7. Why will CVPS buy less Hydro-Québec power than it has in the past?

A7. The volume that CVPS is purchasing is the result of two things: the amount that HQUS is comfortable selling under this arrangement and the allocation of that amount among the Vermont Buyers. We understand from HQUS that the transfer capability at Highgate is a material consideration in its thinking. In effect, we expect that Hydro Québec Production

1 This period is when the bulk of the energy is being purchased. From contract year 2013 to 2015 CVPS will purchase 3 MW of energy per hour (CVPS' VJO Contract entitlement is 116 MW during this time), and from contract year 2036 to 2038, we will purchase 23 MW per hour. These PPA values include the Vermont Marble allocations.

("HQP") (HQUS is the U.S. power marketing affiliate for HQP) wants to deliver a physical hedge to the Highgate node during the sixteen hour daily contract period whenever Highgate is operating in order to offset HQUS' economic exposure in the PPA. Ultimately we expect there should be other future opportunities to buy additional power from HQP given the large surplus HQP plans for export related to other facilities, particularly the new HVDC line planned into New Hampshire.

Q8. How does the pricing of the PPA compare with the pricing of power delivered through the VJO Contract?

A8. First, there are important differences between the contracts so their prices are not directly comparable. For example, the VJO Contract includes capacity while the HQUS PPA does not, and the HQUS PPA contains environmental attributes associated with the energy that must have the characteristics of the HQP system mix (and in any event meet a 90% minimum hydroelectric content requirement). Taking into account the absence of capacity credit in the PPA, the projected first year price of the PPA of about $60/MWh is expected to be somewhat less than the VJO Contract price which we expect to be about $68/ MWh (with capacity) at that time. This relationship is illustrated in Confidential Exhibit CVPS-3.

3. Section 248(b)(2) – Need

Q9. Please describe CVPS' power portfolio and how that supply relates to the Company's load obligations.

A9. The Company's power portfolio is dominated by contracts for power from the Vermont Yankee Nuclear Power Station (the "VY Contract") and the VJO Contract. The VY Contract supplies about 175 MW of capacity and 1.4 million MWh of energy each year. The VJO Contract supplies 143 MW of capacity and over 900,000 MWh of energy. CVPS also owns or has entitlements in about 120 MW of capacity that provide about another 600,000 MWh of energy each year, as follow:

Millstone 3 (nuclear) – 21 MW, 170,000 MWh per year

CVPS Hydro (run-of-river and "weekly") – about 35 MW, 180,000 MWh per year

CVPS Thermal (gas turbines) – 20+ MW, minimal energy

Wyman 4 (oil) – 10 MW, minimal energy

McNeil (wood) – 10 MW, 50,000 MWh per year

SPP's (hydro and wood) – 30+ MW, 175,000 MWh per year

In total, each year our power portfolio supplies about 440 MW of capacity[2] and about 3 million MWh of energy. Our current capacity and retail energy obligations are about 540 MW and 2,350,000 MWh, respectively. Therefore, we are somewhat short in capacity

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2 We also receive about 60 MW of capacity credit for our share of the Phase II transmission facility.

but have surplus energy, which we have been selling forward.[3]

Q10. Section 248(b)(2) requires the Board to find that this PPA is required to meet the need for future demand for service which could not otherwise be provided in a more cost effective manner through energy conservation programs and measures and energy efficiency and load management measures. Please explain how the HQUS PPA satisfies this criterion.

A10. The CVPS purchase of HQUS PPA energy meets the requirement of Section 248(b)(2) due to the need that results from the coming loss of well over half of our power sources. With the expiration of both the VJO Contract and the VY Contract, CVPS faces a major gap in its power supply energy portfolio within the next six years.[4] As shown in the previous answer, CVPS will be left with about 120 MW of capacity and 600,000 MWh of annual energy supply, which represents only about 25% of its power needs. Beginning in November 2016, CVPS' energy deficiency will amount to about 175 MWh per hour on average, or about 2/3 of our average load.[5] Moreover, this deficiency is forecasted to grow over time as CVPS loses its remaining VEPPI power and certain other power entitlements, while load obligations are expected to remain within a relatively narrow band.

3 Normally we sell a large majority of our projected surplus on a calendar year basis, often on a "VY contingent" basis (in order to relieve ourselves from the resale when Vermont Yankee is not operating).
4 The VY Contract expires March 2012, followed by HQ VJO Contract schedules in October 2012 (27 MW), October 2015 (93 MW), and October 2016 (23 MW).
5 The deficiencies will be even greater in the on-peak periods, averaging over 200 MW per hour, growing to about 250 MW per hour in later years.

The proposed HQUS PPA will meet approximately 20%-25% of Central Vermont's annual energy requirements projected for the 2017 to 2035 period.[6] However, even when the power to be purchased under the HQUS PPA and other pending purchases are considered, Central Vermont is left with an average deficiency totaling approximately 110 MW per hour growing in later years to 140 MW per hour (1 million MWh per year growing to about 1.3 million MWh). The energy volume supply gap over time is graphically depicted (with and without the HQUS PPA) in Exhibit CVPS-4, and by on-peak/off-peak periods in Exhibit CVPS-5.

Our load forecast, discussed in the following questions, includes the effects of Vermont's Energy Efficiency Utility ("EEU"). The Board establishes the budget for the EEU. As such, the supply gap that remains represents demand that cannot be met more cost effectively with energy efficiency, as required by 248(b)(2). Under any reasonable expectation with respect to the effect of efficiency on electricity demand, CVPS will be left with a very sizable gap of more than 100 MW per hour. Load management and demand reduction activities primarily tend to affect the timing of consumption and therefore the need for capacity, but not the overall need for energy. Since this PPA does not include the purchase of capacity, we expect little effect of load management and demand reduction activities on energy requirements.

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6 For example, at 555,000 (or so) MWh starting in 2016, this purchase will supply 22% of a 2.5 million MWh expected total CVPS energy requirement.

Under the PPA, should a Buyer not receive needed approval from the Board or from municipal or cooperative voters, the quantity that such a "Removed Buyer" had planned to purchase would become available to the other purchasers for reallocation. Given the size of CVPS' identified supply gap, we ask that the Board grant authority in its order for CVPS to add up to 25 MW of any such Removed Buyer's share of energy and associated environmental attributes without further review by the Board should such power become available. Although not expected, should larger amounts be available, CVPS will seek approval from the Board for any addition greater than 25 MW.

Q11. Please identify and describe the load projections used in your analysis.

A11. Central Vermont's annual retail load obligation is currently about 2.35 million MWh and will increase by about 0.2 million MWh due to the expected addition of Vermont Marble. The merged Company's load is then projected to decrease slowly for a period of time.

Our projection is based upon a 2009 forecast of retail sales prepared by ITRON for CVPS for 2010 – 2016. This forecast was extended out to 2038 using a 0.1% annual decrease, reflecting the trend in the ITRON forecast, and was grossed up for company use and line losses to yield retail load obligation. Since the ITRON forecast does not include the level of energy efficiency savings contained in the EEU's Forecast 20,[7] we employed the adjustments made to the "base" forecast of statewide sales as reflected in Table 1 of Forecast 20 (that is, we added back efficiency savings "embedded" in the base forecast, and replaced them with the higher level now called for by the EEU). Because we begin with an ITRON sales forecast for CVPS that is basically flat due to demography, economic activity and price effects, rather than one having close to a 1% average annual increase, as reflected in the EEU base statewide forecast (contained in Table 1 of Forecast 20), the net reduction we applied to the ITRON forecast is smaller. The result of the adjustments made to the ITRON forecast is a forecast of CVPS load obligations that is much lower than that estimated in Forecast 20. In the end, the Company's annual loads are forecast to decrease between 2011 and 2019 by 100,000 MWh (4%), after which they level off and increase slightly.

Q12. What if your projection of loads is wrong?

A12. The load projection slightly influences overall need but it does not change the need to fill the supply gap that we are facing and therefore the need for the volume provided by the PPA. While there is of course uncertainty in projecting consumer demand over such a long period, we believe that load related risk is not one of the primary risks in evaluating this proposal, with one exception.

7 Pursuant to Paragraph 61 of the Docket No. 7081 Memorandum of Understanding approved by the Board in Docket No. 7081, the EEU prepares a twenty-year forecast of energy efficiency savings expected to be achieved by system-wide efficiency programs. This forecast is referred to as the "Forecast 20."

There are of course new factors influencing demand all of the time but we do not expect them to be of a magnitude that variations in them will affect need to the extent that our remaining gap could close. We expect that automated metering pricing programs, further electrification of transportation, and new electric technologies will each exert new influences. Otherwise, demand will continue to mirror the effects of the major long term trends that have influenced it for the past two decades: slow demographic growth, improved appliance standards, efficiency programs and deindustrialization of the economy. In summary, this means to us that while there will be some unanticipated variation in demand, it will tend to be relatively small and that load overall will be reasonably approximated by the relatively flat long-term trend contained in our analysis.

The one exception we alluded to is public policy. If Vermont were to move to retail open access or significantly expand net metering or the Feed-in-Tariff program ("FIT"), the net demand for power services, that which must be provided by the utilities, could drop significantly. There is not much more we can say or do with respect to such risks but recognize that their potential creates a challenge to be balanced in the process of meeting Vermont's policy preference for long-term stability in the cost of its power sources. In general, we expect that as we replenish the portfolio, we will layer in resources of varying and sometimes quite limited duration such that we could begin to shrink our total portfolio volume over a number of years if further policy changes begin to materialize.

Depending upon the speed with which such changes might occur, there of course remains a possibility that some part of this purchase could become stranded. In a parallel sense, we note that CVPS' IRP for quite some time has identified a goal of keeping a portion of the portfolio in shorter-term market resources in order that retail power costs move somewhat more with the trend in wholesale power costs than our legacy portfolio has in the past.

Q13. How would CVPS' need picture change if the Vermont Yankee facility was to be relicensed, and Vermont utilities were able to negotiate a contract for a portion of its power?

A13. Vermont Yankee's future and moreover its role in CVPS' portfolio is very uncertain at the time we prepare this testimony. Given this uncertainty, CVPS is proceeding with diversification away from our existing 175 MW purchase from Vermont Yankee. As we have more information on Vermont Yankee's relicensing and purchase contract status, we will proceed with other portfolio-appropriate purchases that serve as complements or substitutes as the case may be.

4. <u>Section 248(b)(4) – Economic Benefit & Rate Recovery Assurance</u>

Q14. Section 248(b)(4) requires the Board to find that the HQUS PPA will result in an economic benefit to the state and its residents. How did CVPS go about determining that this purchase is beneficial?

A14. As described, we used three analytical tools to evaluate economic dimensions of the PPA: (1) resource portfolio modeling; (2) multi-attribute scoring and ranking (the "scorecard"); and (3) Monte Carlo simulation.

In the resource portfolio modeling analysis, we applied conventional, quantitative techniques to examine how incorporation of the PPA into CVPS' projected supply portfolio would affect the performance of the overall portfolio in terms of cost and cost risk.

We utilized the scorecard analysis to compare the PPA to alternative supply resources including the renewable power that the Company reviewed during and subsequent to the Joint RFP conducted with Green Mountain Power Corporation ("GMP") and Vermont Electric Cooperative ("VEC") last year (the "Joint RFP"). That analysis consolidates important resource attributes (*i.e.*, cost, cost risk, price stability, environmental attributes, collateral requirements, *etc*.), assigning performance scores for each attribute, calculating total weighted scores for each resource, and then comparing total scores across the resources.

We used the Monte Carlo simulation model to evaluate the PPA's potential performance in terms of annual price outcomes, total contract costs and associated volatilities relative to a full distribution of market price futures. Monte Carlo simulation uses computational techniques that rely upon repeated random sampling of probability distributions describing the key risk variables to analyze problems. We use it to model the power market and the PPA's price by simulating the primary sources of uncertainty affecting their values. From the results of the 2000 futures that were created, we determine the average or expected cost as well as the degree of cost volatility and any asymmetric cost risk inherent in the PPA and an equivalent amount purchased from the New England power market.

Q15. Has the Company employed these techniques in other proceedings or to evaluate other resources and how does the use of these tools support your request for rate recovery of the PPA's cost?

A15. Yes, the Company utilized the scorecard and portfolio modeling approaches to evaluate its proposed power contract with the Granite Reliable wind project. In that proceeding, the Board found that these evaluative tools were developed as part of a "thoughtful and deliberative process" that "seeks to grapple honestly with the trade-offs" among competing power resource and policy objectives.

CVPS has used Monte Carlo simulation extensively since 2001. Simulation is used in almost all evaluations of power sales or purchases, as well as the purchase of Vermont Yankee insurance, non-power projects, and to bound and examine the distribution of projections of costs and resale revenues for budget purposes. Monte Carlo analysis is particularly appropriate with respect to the HQUS PPA because the PPA pricing is a function of uncertain future values of market prices and general price inflation.

By measuring and specifying the parameters of the key variables' probability distributions and through the Monte Carlo simulation of those key variables, we are able to construct a detailed model that portrays PPA pricing results relative to market from repeated randomized draws from these key distributions for the 2000 future scenarios. From this model output one can observe the behavior of the contract's price path under a full range of possible market conditions and characterize the PPA price. In particular, we can quantify:

- the "expected value" – from the measures of central tendency (mean and median);
- "volatility" – from measures of variance (standard deviation); and
- "symmetry" – from measures of shape (skewness and kurtosis).

Understanding how the contract price will behave under different market price circumstances allows one to understand the likely behavior or character of the price-hedge.

Circumstances will vary, but the fundamental nature of the hedge is established by our analysis of the contract's pricing formulae and that will not change. We submit that if the Board judges that the characteristics of the price-hedge represent the characteristics

Vermont wants in its power sources – and we believe that they do – then the Board can determine upfront that the contract represents a prudent hedge and that it is and will be economically useful regardless of which set of future circumstances actually play out. The determined character of the price-hedge is integral support for our request for the Board to grant rate recovery assurance. The worst situation for the utilities, and we believe the public which we serve, would be for the Board to approve this contract as being consistent with the public good and later disallow costs because market conditions change relative to a particular set of today's perceptions.

Q16. What are the benefits that would arise from a Board determination that the cost of this PPA will be recoverable, subject to ongoing management prudence?

A16. The joint Deehan/Cole prefiled testimony provides a general context for understanding the benefits of such a determination. We would only add details of CVPS' specific circumstances that may make the benefits more material.

CVPS is in the midst of one of the most intensive expenditure capital periods in its history. The Board is aware of all of the demands on capital: network reinvestment at both VELCO and on our own network, other asset related efforts such as the purchase of Vermont Marble and its generation assets, and Smartgrid investments. We have established bank lines that are adequate to meet the Company's working capital needs, but they are limited and we do not hold significant cash. The Company has established a budget in order to limit collateral exposure for all power supply activities and thereby maintain overall corporate liquidity. Under the most favorable outcome (rate recovery assurance and continuing investment grade credit status), we will allocate a much less significant proportion of that budget to serve this agreement than under the least favorable outcome (no rate recovery assurance and non-investment grade). Since this purchase will constitute about 20% to 25% of the Company's total energy need, limiting the exposure to the lower proportion of our budget will provide substantially more flexibility within that budget to replenish the rest of the portfolio.

CVPS' corporate credit rating is at the lowest level that is considered investment grade (Moody's Baa3). An order that includes rate recovery assurance will certainly support maintaining that level and could contribute to a future upgrade. Investment grade status is extremely important to our efforts to develop a wide range of possible counterparties, partners and alternatives to replenish the portfolio that serves consumers. Higher investment grade or "higher debt" ratings generally make more counterparties and/or higher collateral thresholds available to us which further increase our flexibility. Capital availability and credit terms improve with higher ratings. All of these matters impact the cost of service upon which rates are based. Consumers are likely to have lower rates and a more desirable power supply if rate recovery is allowed by the Board.

Q17. Please summarize your findings and conclusions with respect to the economic benefit of the proposed PPA.

A17. The HQUS PPA displays a combination of attributes, including the scorecard items and portfolio effects described below, that result in an economic benefit to the state and its residents as required by Section 248(b)(4) relative to the supply alternatives we have reviewed during and subsequent to the Joint RFP, our understanding of Vermont's energy policy preferences, the observed behavior and expected range and level of market prices, interaction with the characteristics of committed resources that remain in the Company's portfolio, and an otherwise open market position (described above in our analysis of need). The PPA prices will be much less volatile than market prices and the contract has an expected or "mean projected" cost that represents a fair deal over the length of the contract. Our confidential exhibits provide the details that support our conclusion that it is a fair deal.

As such, this purchase will increase the price stability of Central Vermont's supply portfolio, reducing ratepayer exposure to market-price volatility driven by fossil-fuel price volatility and other potentially volatile market factors. The HQUS PPA will provide a long-term, largely renewable power source that is stably priced, at price levels that are competitive compared to forecast market prices (as shown in our confidential simulation analysis), much less expensive than other new renewable alternatives and of higher quality than non-renewable alternatives (as shown in our portfolio modeling and scorecard ranking, respectively). It provides a favorable price-hedge and feasible collateral terms that will provide the Company with additional flexibility in securing power supply as new opportunities arise.

Q18. On an expected basis, how does the PPA's cost compare to projections of market prices and to prices for alternative resources?

A18. The PPA is competitively priced compared to the alternatives. Confidential Exhibits CVPS-3, -8, -9 and -10 contain the detailed comparative information that demonstrates that the PPA's pricing is expected to be competitive.

Confidential Exhibit CVPS-3 displays the simple deterministic results of comparing CVPS' base case spot market price forecast, the PPA's price (determined by employing the PPA price formulae consistent with that forecast) and the so-called AESC forecast[8] over the term. In general we believe the chart contributes to a judgment that the PPA's price levels are reasonable. As with each of the confidential exhibits, we have included in Confidential Exhibit CVPS-3, a summary of our confidential observations or "notes" with respect to this chart.

8 The AESC forecast was produced by Resource Insights, Inc. in early 2009 for use by New England state planning agencies establishing energy efficiency goals.

Confidential Exhibit CVPS-8 provides a listing and Scorecard comparison of each of the proposals the Company has evaluated since conducting the Joint RFP in March of 2009. The component scores for the "economic" and "non-economic" attributes are shown. By summing over all of the scorecard indicators, we can see that the PPA ranks 7th of 43. Confidential Exhibit CVPS-8 includes our detailed summary of the PPA's attributes and the levelized cost of each proposal.

Confidential Exhibit CVPS-9 displays the results of portfolio modeling showing the effects of alternative resources, all else the same, on the expected cost and expected volatility of the Company's overall portfolio. This exhibit documents that the PPA is expected to be a valuable addition to the portfolio.

Confidential Exhibit CVPS-10 reports the results from the Monte Carlo simulation that established the expected distribution of contract prices compared to the expected distribution of market prices. This comparison of distributions supports the conclusion that the PPA represents a reasonable price-hedge and its results are consistent with conclusions of the scorecard and portfolio modeling.

4.1. <u>Scorecard Results</u>

Q19. Please describe the origin of the scorecard evaluation tool.

A19. The Scorecard was developed as a screening tool to evaluate and rank various proposals received through the Joint RFP with GMP and VEC for new power supply options, to which counterparties responded on March 18, 2009. The completed Scorecard for the HQUS PPA is shown in Confidential Exhibit CVPS-6. The concept behind the Scorecard was based upon our IRP and it is designed to implement objective, transparent and thoughtful methods that would also serve as a benchmark in making future procurement decisions. The Scorecard was designed to consider and allocate appropriate weights for what we understand to be our stakeholders' preferences for key attributes, and to help the Company implement the resource acquisition strategies contemplated under the Company's IRP.

CVPS, GMP and VEC have received a large number of proposals in response to the Joint RFP, and we have continued to receive offers over the ensuing fifteen months. All proposals have been scored and ranked using the Scorecard. The proposals have ranged from very short-term (one year) to quite long-term (life of unit; twenty-five years), and included a variety of supply types (see Confidential Exhibit CVPS-8).

Q20. Please identify and describe each attribute utilized in the Scorecard.

A20. We utilized the following attributes in the Scorecard:

- **Cost –** (expected) Cost is expressed as a real levelized cost per MWh, calculated so as to put each proposal on a comparable basis for evaluation. The cost score is based on a pre-defined table, created to maintain objectivity, and assign high scores for low-cost resources and low scores for the high-cost resources.

- **Volatility –** (cost) Volatility describes how much the cost of a resource may be expected to vary over time as fuel and other cost inputs fluctuate. Resources with stable prices have little to no variability, while resources based on, or indexed to, some market price are expected to see substantial price fluctuation. For evaluation purposes, low cost variability was assigned the highest score while highly variable resources received the lowest scores, also based on a pre-defined table.

- **Credit requirements –** Posting collateral can be an inefficient use of scarce utility capital resources, can threaten the company's liquidity and crowd out other longer term purchases with collateral requirements, so limiting credit requirements is very important to the Company. Although this item is typically a minor score item, a high requirement can eliminate a resource from further consideration.

- **Credit rating agency treatment –** Contracts that have disproportionate fixed charges can be treated like debt by credit rating agencies, even though they are not *per se* balance sheet debt and can weaken the utility's credit statistics for credit rating purposes.

- **Probability of development or contract performance –** A judgment on the likelihood of whether a resource will be delivered when needed based upon the risks that appear to apply to each proposal.

- **Renewable attributes –** Renewable resources are generally preferred over finite resources.

- **Environmental footprint –** A judgment to distinguish between otherwise similar renewable resources based on their environmental footprint. For instance, biomass generation still emits pollutants and has truck/rail delivery requirements for fuel, both of which a wind resource avoids.

- **SPEED eligibility –** Resources eligible to help achieve the SPEED program goal are preferred over non-SPEED resources. One point worth noting, however, is that if the in-state resources are insufficient to meet the SPEED goal, other renewables, such as out-of-state renewables, that may not otherwise be SPEED eligible may subsequently be deemed eligible to help Vermont reach the SPEED goals or provide RECs that can be retired under renewable portfolio standards.

- **Location –** In-state resources receive preference over out-of-state resources.

- **Delivery point –** Generation delivered to congested settlement nodes is generally more valuable since the LMP is higher at those points. Higher revenues increase the value of the generation resource on behalf of customers.

- **Transmission alternatives –** If a resource can defer or eliminate a transmission upgrade in a certain area, then consideration of the deferral is given to the proposal.

- **Fuel diversity** - A judgment about whether a fuel type would add physical diversification to the portfolio, such that if a physical market were to exhibit operational or reliability problems (*e.g.*, risk that a supplier cannot get wood out of the forest due to high rain volumes) CVPS would be less dependent.

- **Resource diversity** - Small resources receive higher scores than large resources to reflect Vermont's preference for smaller, diverse resources in the supply portfolio used to serve customers.

We assigned 60% of the total weight of the scoring across the first two attributes – cost and volatility of cost – and 40% across the remaining attributes. We discussed other weightings, but the 60/40 split strikes a reasonable balance given that the first two are the primarily pecuniary economic variables, whereas the other attributes include less significant but nonetheless important economic and non-economic considerations.

A detailed discussion of each Scorecard attribute can be found in Exhibit CVPS-7. For each attribute included in the DPS Public Engagement Process, specific reference is made on the Scorecard to the page and section of the Public Engagement Report published by the DPS that suggests preferences for the particular attribute.

Q21. What is the range of possible scores that can be assigned to any particular proposal attribute?

A21. A score of between a continuous scale of 0 and 6 was assigned to each Scorecard attribute. For any particular attribute, a score is assigned considering the following:

Judgment of Proposal Attribute is:	*Score is:*
No Value; Unlikely; Unattractive	0
Potentially Favorable Terms; Possible; Fairly Attractive	3
Superior Value; Highly Likely; Very Attractive	6

In addition, because many of the attributes carry low relative weights, "wildcard" scoring allows for weighting certain key attributes either higher or lower. A wildcard score between -20 and +20 adjusts the standard score if, in our judgment, the score the attribute receives is incomplete and does not fully describe its benefit or risk.

Q22. How did the HQUS proposal score relative to other resource proposals the Company has considered?

A22. HQUS scored favorably compared to Joint RFP resources and to other contemporary proposals since the Joint RFP concluded. *See* Confidential Exhibit CVPS-8. Five of the six proposals that scored higher than the HQUS proposal are either already under contract or under negotiation, so we are making earnest attempts to contract for the "best of the best" resources available to us. A supply resource receiving a high score *relative to other competing or comparable resources* suggests that the proposal is superior in striking the reasonable balance being sought among all attributes considered in the screening tool. *See* Confidential Exhibit CVPS-6 for the detailed PPA scorecard.

4.2. <u>Portfolio Analysis</u>

Q23. Please explain the concepts and methods underlying your portfolio analysis.

A23. The theory and techniques of resource portfolio management are borrowed directly from conventional portfolio management practices in the financial/investment sector. The basic notion is that the economic evaluation of an asset should relate to its impacts on the overall performance of the asset portfolio to which it is being added. Overall portfolio performance is measured along two dimensions, cost and cost risk, or cost volatility.

Q24. Generally speaking, how does the incorporation of a new resource into a portfolio of existing resources affect overall portfolio performance in terms of cost and risk?

A24. The impact on cost is quite straight forward. The unitized cost (*e.g.,* cost/kWh or cost/kW) of a utility's supply resource portfolio is equal to the volume weighted, expected or average cost of its component resources. So, the introduction of a new resource will lead to an increase in overall portfolio cost when, all other things being equal, its stand-alone cost exceeds the unitized portfolio cost, and it will lead to a decrease in overall portfolio cost when its stand-alone cost is lower than the unitized cost of the existing portfolio.

Q25. How do you measure portfolio risk, and how does a new resource affect portfolio risk?

A25. For this purpose, portfolio risk is measured by the standard deviation ("standard deviation" or "SD") of unitized cost. Standard deviation is a statistical variable that measures the dispersion of possible outcomes around the expected outcome. We estimate the expected values of annual portfolio costs, but we realize that the actual values can, and most likely will, be different than expected. Standard deviation helps us express how wide the range of possible outcomes is. The higher the SD, the greater the portfolio risk, and the lower the SD, the lower the portfolio risk. However, unlike the situation with cost, we cannot say that the addition of a resource with a SD higher than the portfolio's will raise the portfolio SD, or that incorporation of an asset with a lower SD will lower portfolio risk.

Q26. Why is that?

A26. An important implication of modern portfolio theory is that overall portfolio risk can be lower than the stand-alone risk of any single asset in the portfolio. Thus, it is quite possible that portfolio risk can be lowered by adding an asset with higher stand-alone risk. This dynamic underlies the power of asset diversification, which financial planners advise should be pursued in our personal investment plans. The key factor relates to the degree and direction of correlation (or covariance) between price movements of the assets. Successful diversification leads to less volatility in overall portfolio returns because adverse price changes for some assets are offset by favorable price changes for others. This occurs when asset prices are negatively correlated, and to a lesser degree when price movements are uncorrelated or only slightly correlated.

Q27. Does this notion also apply to power resource portfolios?

A27. Yes, in a resource portfolio we are concerned with cost and cost risk, and the impact of a new resource on overall portfolio risk will depend on the correlation between the cost movements of the new resource and the cost movements of the other resources in the portfolio. The addition of a resource that displays negative cost correlations (counter-cyclical costs), no cost correlations, or only slight positive cost correlations will tend to lower portfolio risk.

Q28. What does your portfolio analysis indicate about the HQUS PPA as an addition to Central Vermont's power supply portfolio?

A28. The analysis indicates that the addition of the PPA will be good for the portfolio. Confidential Exhibit CVPS-9 provides graphical illustration and notes related to these impacts. This exhibit contains three graphs which show the results of our portfolio analysis. We will highlight aspects of our analytical methods as we discuss the graphs.

Q29. Please explain what the graphs shown in Confidential Exhibit CVPS-9 illustrate.

A29. The graphs have the same structure but depict different situations or scenarios. On each graph, the vertical axis shows expected cost in cents/kWh and the horizontal axis shows risk or standard deviation. Cost is measured by a variable called real levelized cost ("RLC"), which is a summary statistic that allows for direct comparison of the life-cycle costs of differently lived projects, and risk is measured by the standard deviation of annual cost changes.[9] The cost and risk measurements are at the total portfolio level and the planning horizon is twenty years. Each of the labeled points represents the cost and risk values for a particular portfolio. The first graph ("Graph 1 of 3") shows four separate points each representing a different portfolio. Two points lie in the upper left of the graph and two points lie in the lower right. The points in the lower right show outcomes related to a "Benchmark" portfolio, which reflects a combination of CVPS' existing, committed resources and a market proxy adequately sized to cover the uncommitted component needed to meet load requirements. The two points in the upper left show outcomes related to a hypothetical "Fixed Benchmark" portfolio, which reflects CVPS' committed resources coupled with a "fixed price proxy" in the place of a portion of the uncommitted component. The fixed price proxy was derived by calculating the nominal, levelized value of projected market prices and increasing it by 10% to reflect a premium for price stability. This premium is hypothetical in the sense that we don't have a scientific means of measuring it from market results but we believe that it is reasonable and its use facilitates the illustration of important aspects of portfolio management's dependency on the starting-point portfolio.

Q30. Please explain the two portfolios in the lower right.

[9] In this context, "Real Levelized Cost" refers to the present value of the total, unitized cost of a proposed purchase over its economic life, converted to constant annual payments. Costs are levelized in real dollars (*i.e.*, adjusted to remove the impact of inflation). Use of RLC allows for direct comparisons of the life-cycle costs of differently-lived resources.

A30. The two points are labeled "CVPS Benchmark" and "Benchmark w/HQUS PPA," respectively. As described above, the Benchmark portfolio combines CVPS' committed resources with a market proxy. The "Benchmark w/HQUS PPA" portfolio replaces the appropriate portion of the market proxy with the HQUS PPA. By comparing the relative positions of the portfolios we can see how inclusion of the PPA affects the economic parameters of the overall portfolio. One can see from this first graph that the addition of the PPA generally represents improvement in the portfolio.

Q31. Please explain the two portfolios in the upper left.

A31. The analysis and interpretation are the same but in this case the points are labeled "CVPS Fixed Benchmark" and "Fixed Benchmark w/HQUS PPA." As the labels imply, they are based on the Fixed Benchmark portfolio, which combines CVPS' existing, committed resources with the fixed price proxy resource in replacement of a portion of the portfolio that would otherwise be short to the market. Again, we can see how inclusion of the HQUS PPA affects portfolio cost and risk by comparing the relative positions of the two points. As in the previous case, inclusion of the PPA represents an improvement in the Fixed Benchmark Portfolio. In a relative sense, risk is lowered more in the Fixed Benchmark scenario than in the Benchmark scenario because in the Fixed Benchmark case, there is less total risk to begin with so the risk reduction inherent in the PPA eliminates a larger share of the cost risk that remains.

Q32. Did you use the portfolio analysis to compare the PPA to other potential supply resources?

A32. Yes. The second graph of Confidential Exhibit CVPS-9 ("Graph 2 of 3") shows the comparative portfolio impacts of the PPA and several other potential supply resources that were proposed in the Joint RFP conducted by CVPS, GMP and VEC. The interpretation of Graph 2 of 3 and its vertical and horizontal scales is the same as we have described for Graph 1 of 3 in Confidential Exhibit CVPS-9. Note the Benchmark portfolio includes the resources that were selected in the RFP. Graph 2 of 3 shows how various alternative supply resources compare to one another in terms of their relative impacts on portfolio cost and risk. There are seven points, one labeled "Benchmark," one labeled "HQ PPA" and each of the other five labeled with a single letter and associated technology type. Again, each point represents a different portfolio configuration. The Benchmark portfolio is the same as described above. The point labeled "HQ PPA" represents the benchmark portfolio with the inclusion of the HQUS PPA. Each of the other points show results for a particular portfolio made up of the Benchmark and a particular alternative supply resource. Letter designations are used to avoid identifying the individual suppliers by name, but the technology type for each project is presented.

Q33. How should the graph be interpreted?

A33. It allows us to compare the alternatives in terms of their impacts on portfolio cost and risk. We can determine whether any projects are clearly superior (i.e., lower expected cost and/or risk relative to alternatives with the same or higher expected cost or risk) to others and we can see, and compare, the trade-offs associated with the individual projects. This comparison also supports the economic benefit of adding the PPA to the portfolio relative to other alternatives that have not been pursued.

It is important to note that the PPA represents a significantly greater volume of output than the other resources, and thus the comparative impacts of the PPA shown on Graph 2, may, in some sense be exaggerated to the eye. The third graph of Confidential Exhibit CVPS-9 ("Graph 3 of 3"), has the same structure and interpretation as Graph 2 of 3, but in this case we produce an approximate volume "equivalency" between the PPA and the other alternative resources by artificially scaling down the PPA volume to a level equal to the average output of the other resources. In other words, Graph 3 of 3 shows the impacts of each resource, per MWh of output, on total portfolio cost and risk.

Q34. Please describe the results shown on Graph 3 of 3 of Confidential Exhibit CVPS-9.

A34. Graph 3 of 3 also demonstrates that the addition of the HQUS PPA to CVPS' portfolio would represent an improvement to the Company's portfolio but it shows that when the purchase is scaled for comparison, we cannot conclude that the PPA is unambiguously superior to a subset of the alternative resources. Such a resource would represent the "Holy Grail" for a resource planner so we do not consider this conclusion to be a negative relative to other resources. And importantly, we cannot lose sight of the results on Graph 2 of 3, which shows the substantial comparative benefits of the full PPA, because it is one of the few resources that is actually available in the proposed volumes, so it is actually capable of producing the larger positive effects shown on Graph 2 of 3.

Q35. Please summarize your conclusions regarding the economics of the HQUS PPA as reflected by your portfolio analysis.

A35. Portfolio analysis evidences that the PPA is an attractive addition to Central Vermont's portfolio. In our experience, we have not seen other new alternatives that produce the degree of beneficial effect on the portfolio as the PPA, and in our experience that makes this is a special economic opportunity for consumers.

4.3 <u>Monte Carlo Simulation Model</u>

Q36. Earlier you indicated that CVPS ran a Monte Carlo simulation model to test the price performance of the PPA. Please explain this process, the results, and how this analysis relates to your portfolio analysis.

A36. As described in the joint Deehan/Cole prefiled testimony, several uncertain factors will determine the realized annual prices under the PPA and their relation to market prices. Two of the most important drivers, energy prices and general price inflation, are subject to uncertainty and this of course makes the results of the evaluation of the PPA prices uncertain and variable. The Monte Carlo simulation process enables us to model annual

PPA prices and the resulting range of potential overall contract outcomes based on the inherent variability in the underlying price drivers, while comparing that resulting range with a consistently constructed cost range for an equivalent volume of market purchases. The model produces a large number of possible values of annual PPA prices (for each twenty-six year future, we produced 2,000 outcomes), based on simulated values of the causal variables. The projected annual prices are used to calculate the expected total present value cost of the contract, and these results are consistently compared to market outcomes to assess the efficacy of the PPA. The model's specifics and the full distribution of results are presented in Confidential Exhibit CVPS-10.

Q37. What does the Monte Carlo analysis indicate about the HQUS PPA?

A37. The analysis displayed in Confidential Exhibit CVPS-10 shows that the PPA is a fair deal relative to market. Potential price variability is substantially lower under the PPA formula than from the market and the central measures of the distributions, mean and median, demonstrate that the price level is competitive. Overall the distribution of potential results is therefore in closer alignment with Vermont's policies and preferences than would be a like annual purchase priced at market.

The PPA's cost variability is lower because of the pricing formula's hedging characteristics. The pricing formula removes market price variability by blending market price values with the influence of a broad-economy inflation measure and limiting annual contract price changes. The formula is a hedge for both sides and therefore consumers are protected from volatile market highs such as those experienced from 2004 through 2008.

Q38. How does the Monte Carlo analysis relate to your portfolio analysis?

A38. Both methods consider both cost and risk but the portfolio model measures how the addition of a particular resource will affect the cost and risk of the overall resource portfolio, while the Monte Carlo simulation focuses on the cost and risk of the stand alone asset. In this case, the Monte Carlo model result is consistent with our portfolio modeling results and that consistency follows from the nature of the PPA price formula which by its construction must be less volatile than market pricing. The portfolio model indicates that the introduction of the PPA into the Company's supply resource portfolio will improve the overall portfolio by replacing a large component that would otherwise remain "open" to the market. Thus, both analyses produce consistent results and indicate that the PPA is economically beneficial.

5. <u>Consistency with CVPS IRP</u>

Q39. Please explain how the HQUS PPA complies with the Company's IRP as required by Section 248(b)(6).

A39. Central Vermont's power purchase under the HQUS PPA is consistent with the principles for resource selection expressed in the most recent least-cost integrated plan of CVPS. The PPA is part of CVPS' efforts to implement the power supply portion of its 2007 IRP through a diverse program of competitive RFP processes, bilateral negotiations and SPEED FIT resources. The HQUS PPA resource was selected based upon the application of screening and evaluation tools, which are identified in our IRP to identify and select among potential new supply resources. These tools were reviewed in workshops in the Company's recent IRP proceeding in Docket No. 7284. A proposal for decision by the hearing officer in that docket that recommended Board approval of the IRP was circulated to the parties in that docket on November 20, 2009.

In addition, the IRP specifically identifies HQ contract extension negotiations in the "timeline for electric future" on page 3 of the 2007 IRP. Note that this is a process flow line showing as a "Resource Choice(s) and Approval" step for a successful HQ contract extension planned for 2009. The HQUS PPA was also selected by CVPS in furtherance of Vermont energy policy as expressed in 30 V.S.A. §§ 202a, 218c, 8001(a), 8005, and the 2005 Vermont Electric Plan, and the preferences expressed by customers as defined through the state-managed public engagement process named "Vermont's Energy Future."

Q40. Please explain how the HQUS PPA meets the criteria for resource selection in the Company's IRP.

A40. The screening tools utilized to evaluate the HQUS PPA are the IRP analytical tools developed and demonstrated in the Company's most recent IRP proceeding before the

Board. The tools embody the IRP's selection criteria. Proposals that generate very favorable analytical results from these tools, such as the HQUS PPA, strongly meet our IRP resource selection criteria.

Q41. Does this complete your testimony?

A41. Yes.